Evolutions in Policy, Markets and Measurement of Emissions

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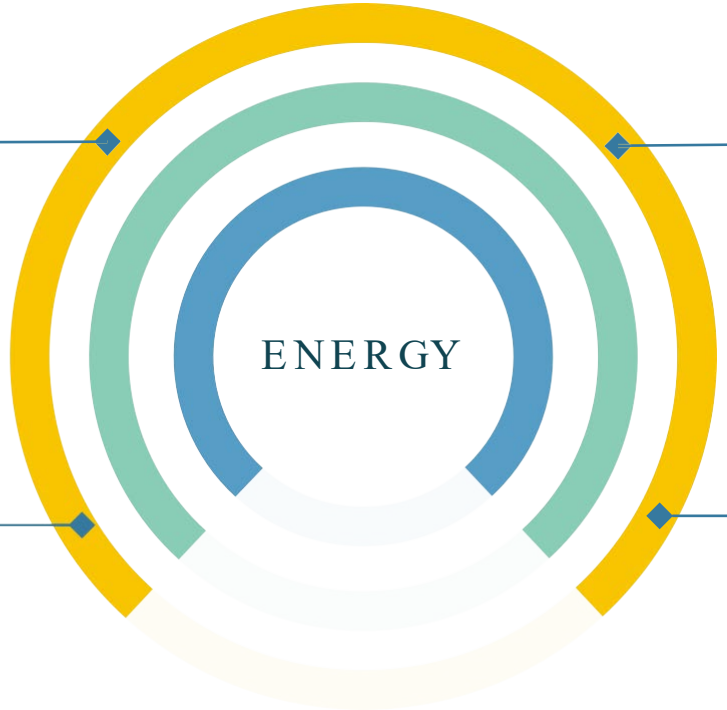
Pressure to Disclose and Prove Emissions Reductions

INVESTORS

- Sustainability-linked lending
- Differentiate vs. divest
- Environmental impact disclosures

REGULATORS/NGOs

- OGMP 2.0
- Federal - EPA, FERC, SEC, FASB
- State agencies and PSCs/PUCs
- EDF and other NGOs



OPERATORS

- Branding
- Access to capital
- Operational excellence

END CONSUMERS

- LNG (Europe & Asia)
- Utilities (IOUs, munis, co-ops)
- Industrials

UPSTREAM, MIDSTREAM, DOWNSTREAM

Federal, State and European Policy Evolutions

Emissions Measurement Is Key Focus Across Multiple Ongoing US Rulemaking Processes

Inflation Reduction Act

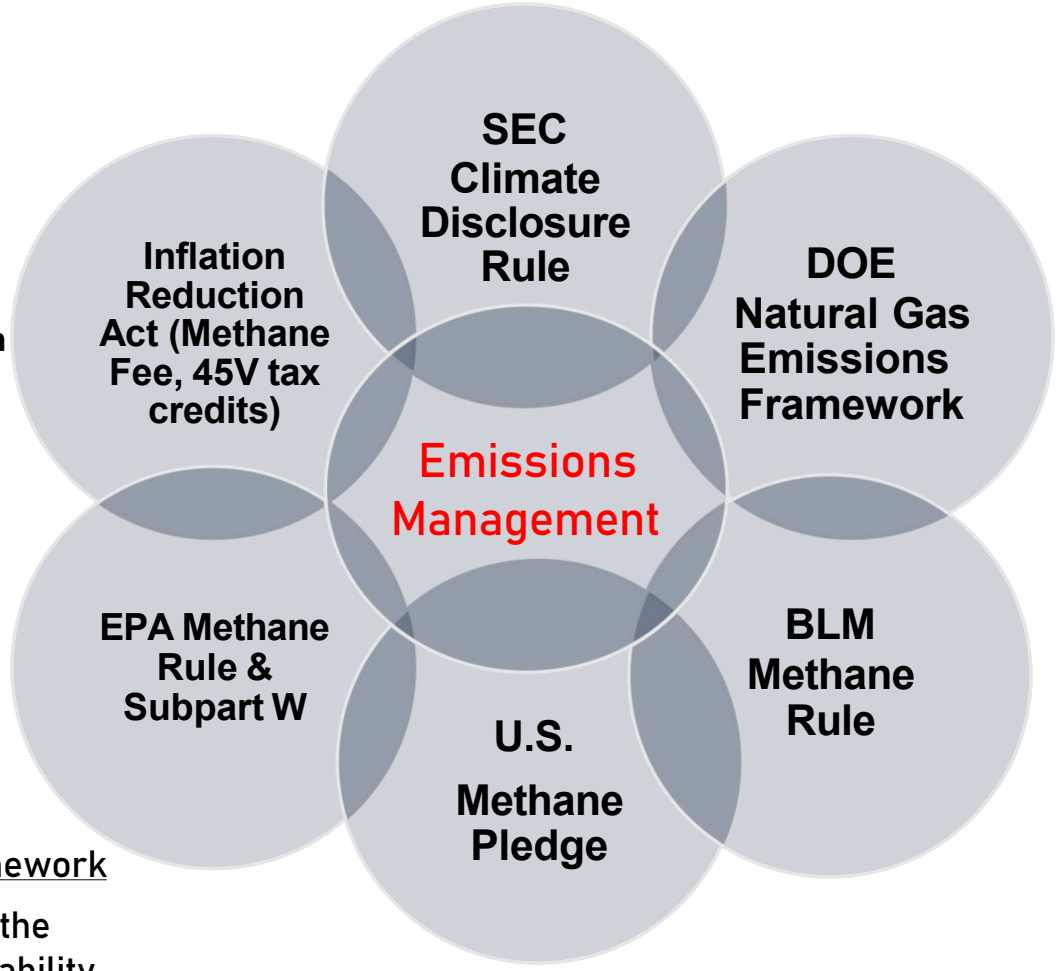
- Methane Fee & new "empirical" data emissions reporting requirements and royalty collections for oil/gas operations on federal lands.
- **Clean hydrogen tax credit, 45V, which provides $3/kg in credits for hydrogen manufactured with < 0.45kg lifecycle CO2e emissions per kg of hydrogen produced.**

EPA Methane Rules

- New rules and enhanced accuracy of emissions data reported to EPA

DOE Best Management Practices Framework

- Use of direct measurement can be the basis of transparency and transactability



SEC Climate Disclosure Rule

- Required to produce consistent, comparable, and reliable GHG emissions disclosures for investors

BLM Waste Prevention Rule

- Require accurate accounting under new royalty provisions in the Inflation Reduction Act

U.S. Methane Emissions Reduction Action Plan – Global Methane Pledge

- Accurate global tracking of methane emissions

EU Defining Regulations for Natural Gas Imports

Regional Controls and Imports

M

01

Measurement

Regional EU controls. Imported nat gas must meet controls that are "regulatory equivalent" to EU controls

R

02

Reporting

LNG Importers must report methane levels to EU Member States

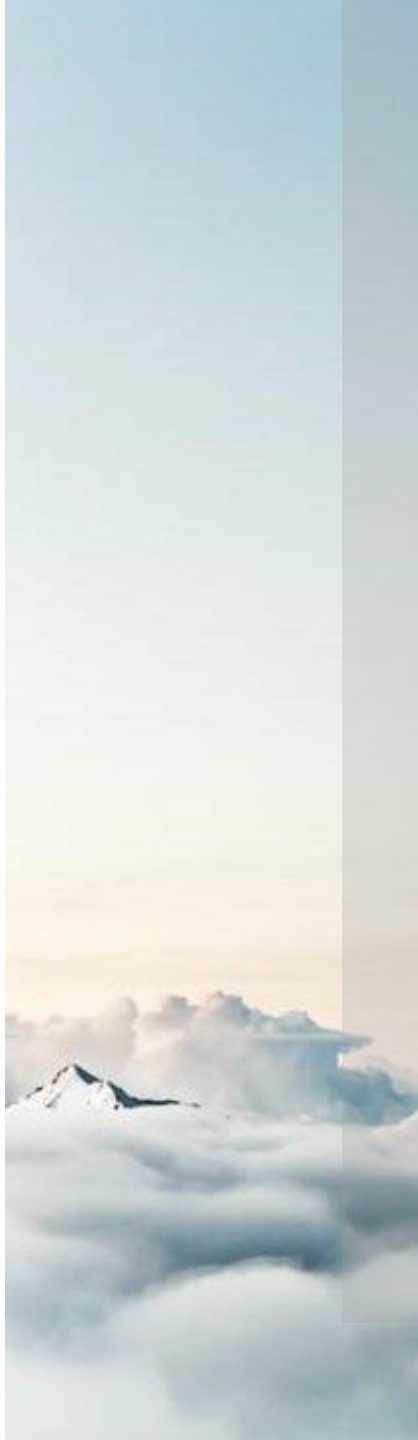
V

03

EU Imported Gas Verification

Methane reporting must be verified by an EU-accredited independent verifier

Rule in Force end-2023; Delegated Acts to Commission finalized 2025



State Policy Initiatives

State governments are evaluating options to reduce emissions, encourage certified natural gas utilization, and enable utility cost recovery for acquisition of low emission gas

Agency Activity

- **Colorado** – multiple regulatory initiatives underway
  - Methane Intensity Verification Rulemaking
  - Best Management Practices
  - NOX/GHG reduction
- **Pennsylvania**
  - Considering performance-based permitting using air quality metrics
- **New York**
  - Climate Leadership & Community Protection Act recognizes reductions in Scope 3 emissions

Legislative Activity

- **Proposed California SB-781**
  - Imported low emission natural gas procurement policy under consideration in the Senate
- **Tennessee Natural Gas Innovation Act, HB2315**
  - Enacted 2022 and authorizes utility cost recovery of innovative natural gas resources
- **Virginia Senate Bill 565**
  - Enacted 2022 and permits utilities to include supplemental forms of gas in fuel portfolios

Overview of RSG Market

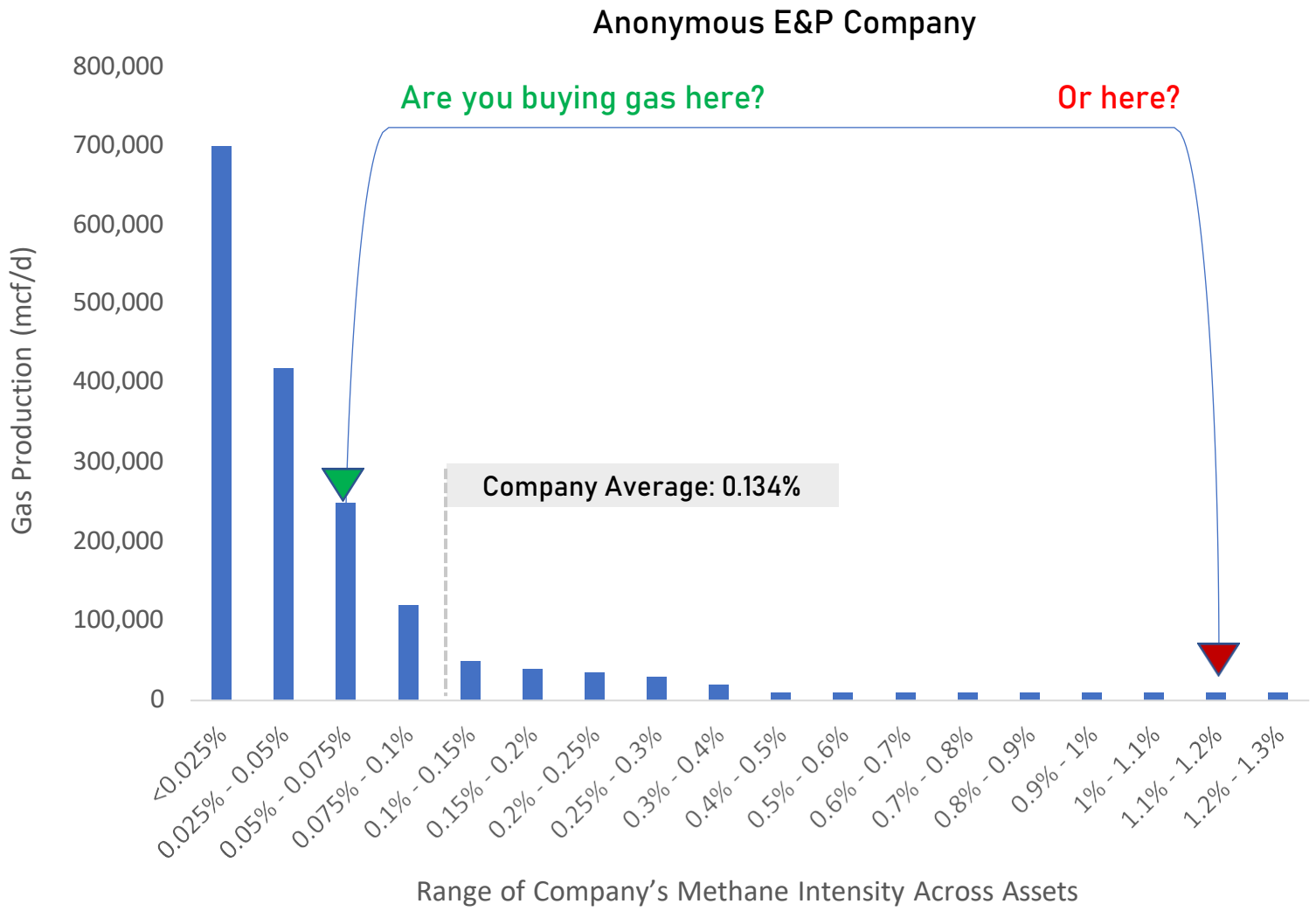
What is Responsibly Sourced Gas (RSG) or Certified Gas or Differentiated Gas?

- Certified gas undergoes independent, 3rd-Party assessments or scoring of environmental best practices
- Buyers use Purchasing Power to reduce methane emissions and other environmental impacts of natural gas production
- Low Methane Intensity: certified gas verify methane intensities below 0.20% at each well or basin
- Other Environmental Attributes can be evaluated: Low Water Usage, safety, land, community impacts
- Large Volumes Available: 25%+ of US gas market is certified

Demand Side: Utility Buyers

- **New York Power Authority (NYPA**) - 3 x 30-day RFPs in 2022, with premium
- **Central Hudson Gas & Electric** - 6-month pilot May-Oct 2022 for 20% of total volume, with premium
- **Orange & Rockland** - PUC approved RSG pilot with cost recovery, $100k/yr cap for premiums
- **ConEdison** - Filed for permission to pilot RSG with cost recovery, $800k/yr cap for premiums
- **NY State Electricity & Gas and Rochester Gas & Elec (Avangrid)** – Filed for pilots with cost recovery, $250k/yr cap
- **Xcel Energy** – Early adopter, commitment to 100% RSG by 2030
- **Southern Company Gas (NICOR, Virginia Natural Gas)** - Early adopter, 18BCF since 2019, ~1/3rd of customer demand
- **Enbridge Gas Inc.** – filed annual gas plan including quantification of emissions reductions based on certified gas purchases

Why Data Matters



Source: Anonymous E&P company

Cost Savings From Buying Lower Emissions Gas Relative to Carbon Prices

Cost per MCF of Credits Given Varying Methane Intensity ($/mcf)								
	0.01%	0.05%	0.10%	0.15%	0.20%	0.25%	0.30%	0.35%
$20	$ 0.00	$ 0.02	$ 0.03	$ 0.05	$ 0.06	$ 0.08	$ 0.09	$ 0.11
$30	$ 0.00	$ 0.02	$ 0.05	$ 0.07	$ 0.09	$ 0.11	$ 0.14	$ 0.16
$40	$ 0.01	$ 0.03	$ 0.06	$ 0.09	$ 0.12	$ 0.15	$ 0.18	$ 0.21
$50	$ 0.01	$ 0.04	$ 0.08	$ 0.11	$ 0.15	$ 0.19	$ 0.23	$ 0.26
$60	$ 0.01	$ 0.05	$ 0.09	$ 0.14	$ 0.18	$ 0.23	$ 0.27	$ 0.32
$70	$ 0.01	$ 0.05	$ 0.11	$ 0.16	$ 0.21	$ 0.26	$ 0.32	$ 0.37
$80	$ 0.01	$ 0.06	$ 0.12	$ 0.18	$ 0.24	$ 0.30	$ 0.36	$ 0.42
$90	$ 0.01	$ 0.07	$ 0.14	$ 0.20	$ 0.27	$ 0.34	$ 0.41	$ 0.47
Annual Cost to Offset for 100,000 mcf/d:	***$365K***	***$ 1.1M***	***$2.2M***	***$3.3M***	***$ 4.5M***	***$ 5.5M***	***$6.6M***	***$7.7M***

Sources: EPA, Wood and Mackenzie.
1. Stated EDF methane intensity of natural gas of 1.38%. Expresses methane emission per unit of gross gas production; the 0.454% figure includes only production operations and implicitly attributes all methane emissions from natural gas wells to natural gas production.
2. TrustWell® cutoff for certified gas methane intensity that a best-in-class operator can achieve.
3. The Intergovernmental Panel on Climate Change (IPCC) has indicated a GWP for methane of 82.5 when considering impact over a 20-year timeframe.

Engagement in Certified Gas is Increasing Along the Value Chain

Supply Chain – Wellhead to Market

Upstream	Gathering/Processing	Interstate Pipeline	LNG	Utilities
CIVITAS	OLYMPUS ENERGY	TALLGRASS ENERGY	NEXTDECADE	People. Power. Possibilities. Central Hudson A FORTIS COMPANY
swn Southwestern Energy	Chevron		uniper	New York Power Authority
PUREWEST Essential Energy. Responsibly Produced.			ENGIE	New Jersey Natural Gas
PENNENERGY RESOURCES				Southern Company
				Xcel Energy
				ENBRIDGE
				Washington Gas A WGL Company

Recent Developments in the RSG Marketplace

Organizations and buyers alike are establishing RSG standards and several transactions have been recently announced.

Setting Standards

EDF Environmental Defense Fund — Finding the ways that work

The Payne Institute for Public Policy — Colorado School of Mines

MiQ / RMI

S&P Global

Buyer Recent RSG Transactions

Bloom energy · ENGIE · New Jersey Natural Gas

TVA · Virginia Natural Gas · uniper

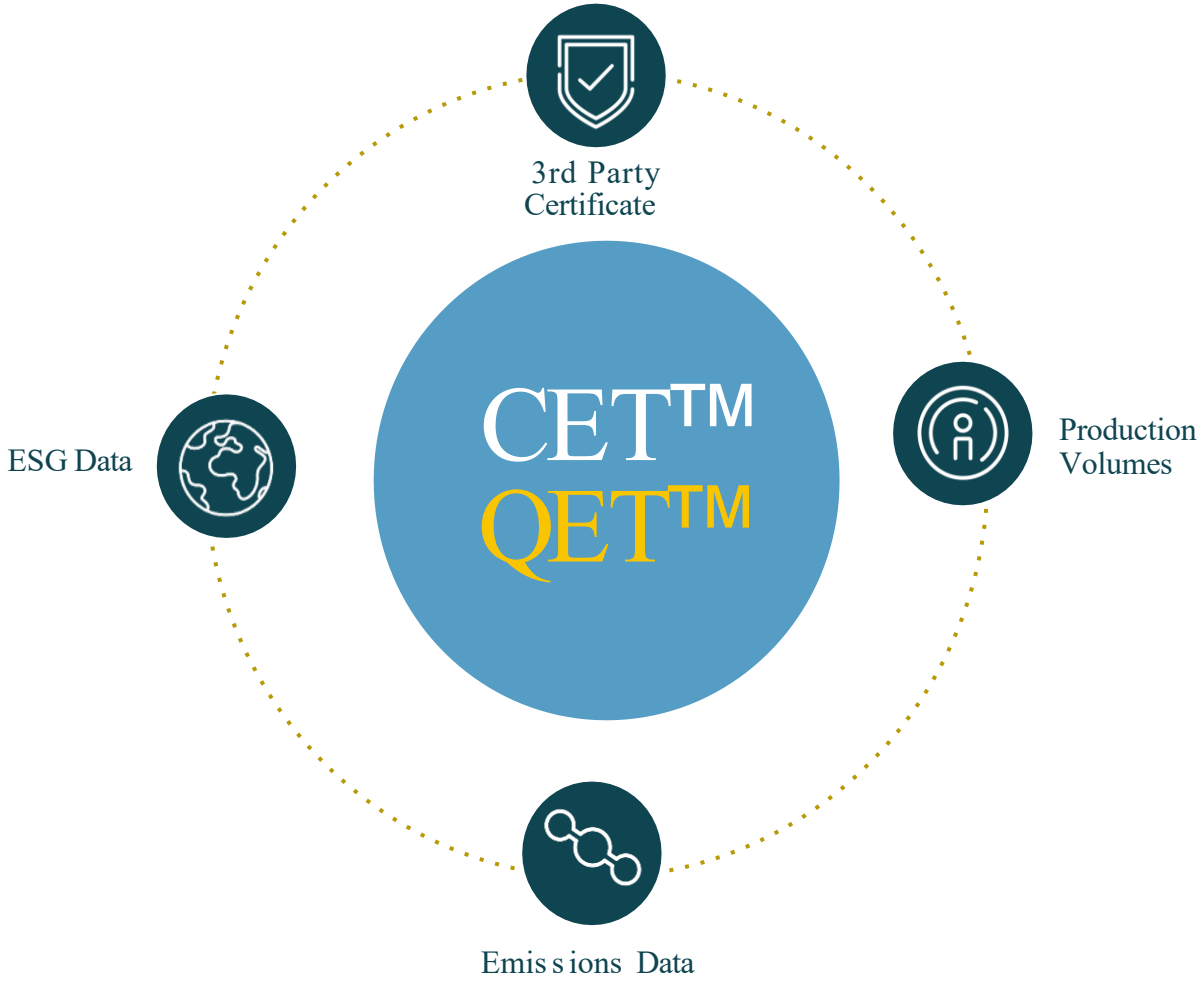
Xcel Energy · Washington Gas — A WGL Company

Some buyers have set their own standards

Registries Support Certified Gas Transactions

Registries Continue Strong Momentum: Accurate. Easy. Auditable.

- Registries create digital environmental attributes
- Allows gas buyers & sellers to see granular data and manage emission profiles
- Traders/Originators can incorporate the lowest methane intensity into transactions with their end use customers.



How Does This Work?

CISION

PureWest Energy and Proman Sign Agreement to Reduce Scope 3 Methanol Footprint Through Digital Tokens

yahoo!finance

Illustrative Transaction From Wellhead to Retirement

Generate

Generate environmental assessment and quantification data at the wellhead

Transfer

Digitally transfers environmental attributes to EarnDLT's immutable ledger on the blockchain

Tokenize

EarnDLT creates a digital token that represents one digital molecule (i..e mmbtu) with the relevant environmental attributes to reflect either a CET or QET

Exchange

Stakeholders see environmental attributes associated with a specific volume of gas and determine price they will offer

Retire

Once tokens are purchased and executed, they are retired to avoid double-counting

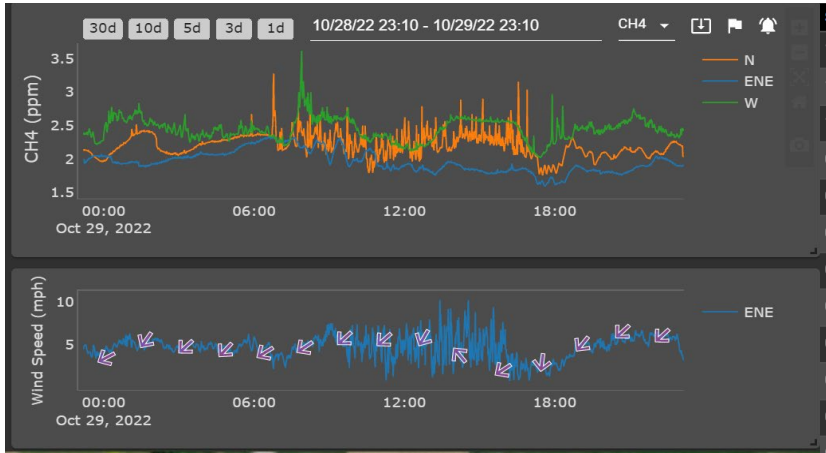
Evolutions in Monitoring Emissions

Emissions Monitoring and Quantification: What Have We Learned?

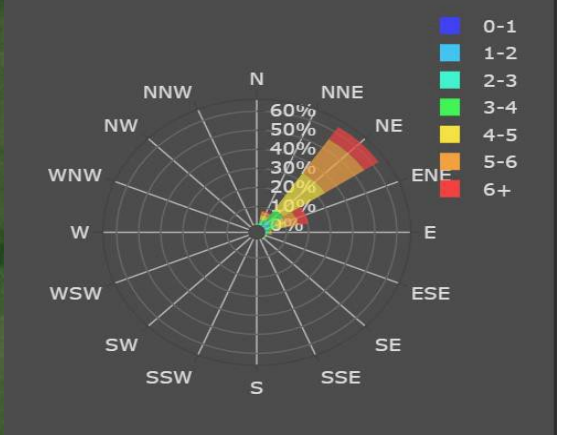
- Monitoring results in reductions: 9 month study involving flyovers and continuous emissions monitors by EEMDL/Cheniere (see footnote)
  - Top down measurements all higher than bottoms up
  - Site level measurements were sometimes higher and sometimes lower than bottoms up
- Quantification is complex! No single model works for every facility
- Need to understand how methane emissions change based on geographic, atmospheric, topographic, and temporal variables and what are the best applications for technologies
- A portfolio of technologies is needed to create a "digital canopy" of air emissions

"Toward multi-scale measurement informed methane inventories: reconciling bottom-up inventories with top-down measurement using continuous monitoring systems"
https://chemrxiv.org/engage/chemrxiv/article-details/63e526b9fcfb27a31f7c0a6c
Energy Emissions Modeling and Data Lab, The University of Texas at Austin and its partners

Emission Monitoring Dashboard

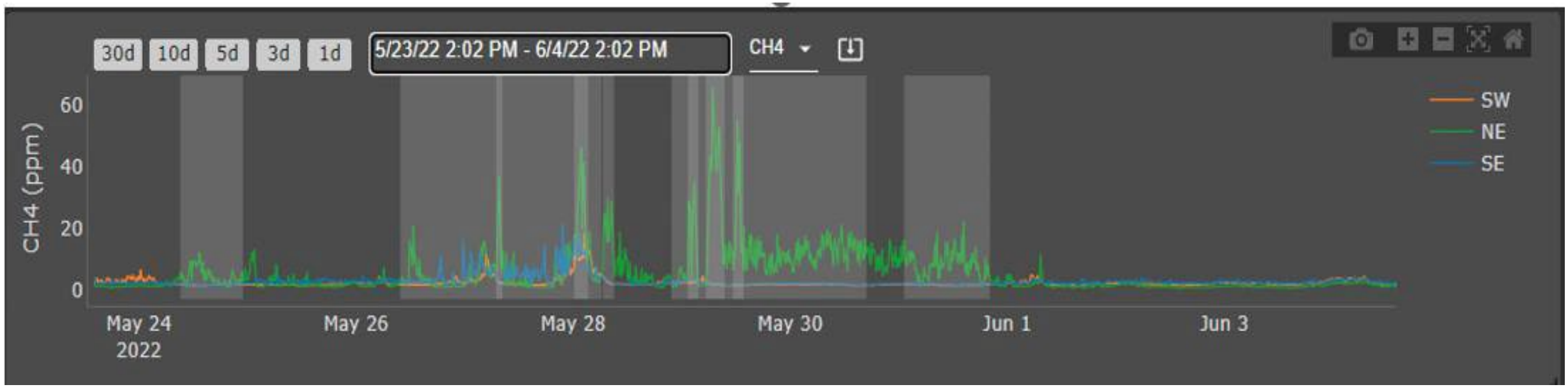


Start	Duration	Condition
10/22/2022 06:33	131 min	7.7 (60m Avg) >= 5 ppm CH4
10/22/2022 02:54	119 min	6.7 (60m Avg) >= 5 ppm CH4
10/21/2022 21:10	66 min	5.2 (60m Avg) >= 5 ppm CH4
07/27/2022 02:54	184 min	6.1 (60m Avg) >= 5 ppm CH4
07/25/2022 06:23	105 min	6.3 (60m Avg) >= 5 ppm CH4
07/23/2022 01:18	109 min	6.4 (60m Avg) >= 5 ppm CH4
07/14/2022 04:09	215 min	13.6 (60m Avg) >= 5 ppm CH4
07/13/2022 23:23	120 min	8.1 (60m Avg) >= 5 ppm CH4
07/13/2022 15:50	1070 min	Smart Alert Triggered
07/13/2022 15:23	317 min	11.9 (60m Avg) >= 5 ppm CH4
07/13/2022 11:06	92 min	5.5 (60m Avg) >= 5 ppm CH4
07/13/2022 07:33	94 min	5.0 (60m Avg) >= 5 ppm CH4



Detect, Resolve and Quantify Leaks

- Alert indicated a methane leak
- Operator analyzed wind and emissions data to source leak to a cooler line and verified using OGI camera
- Quantify the emissions during the leak event

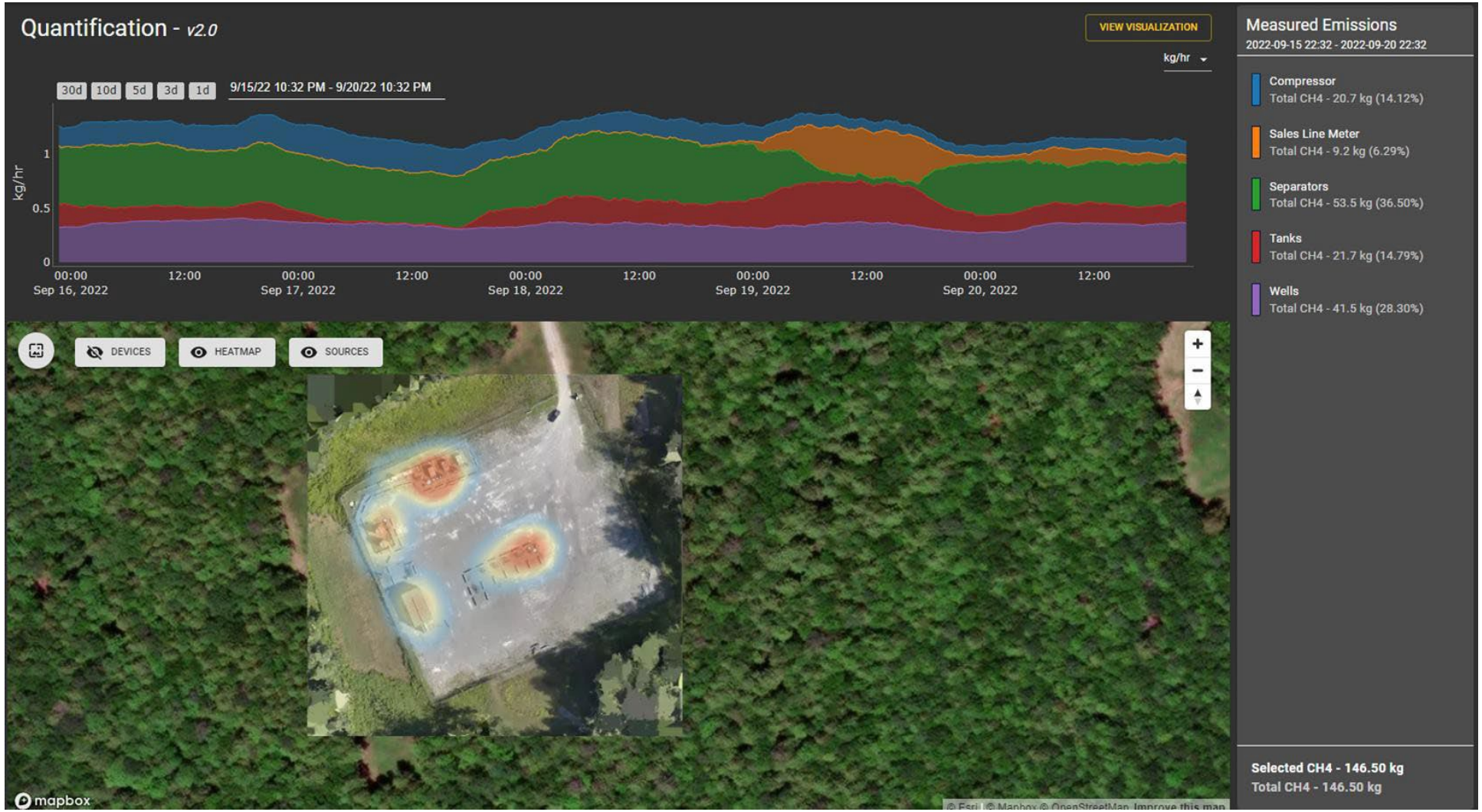


Common Issues Identified Due to Emissions Alerts

Problem	Event Type	Time from Alert To Fix Source Attribution/Remediation	Solution
Liquid Knock Out Tank Frozen	Normal Operation	73 hours	Frozen tanks had to have their vapor lines disconnected, leading to emissions.
Inefficient Flaring	Hardware Inefficiency	42 hours	SCADA data confirmed that a combustor didn't light, flow pressure issues fixed - improving combustion.
Vapor Recovery Unit Pressure Issues	Hardware Inefficiency	7 hours	Vapor Recovery Unit pressure levels accounted for preventing continued emissions.
Thief Hatch Left Open	Leak	4 hours	Operations team made aware of event; hatch closed, leak remediated.
Unplanned Storage Tank Venting	Hardware Inefficiency	40 minutes	A seal was stuck open, leading to pressure buildup in storage tanks leading to venting. Closing the seal fixed the issue.
Water Hauling Emissions	Process Inefficiency	10 minutes	Oil Field Services company didn't connect to vapor line. OFS companies addressed by HSE Dept.

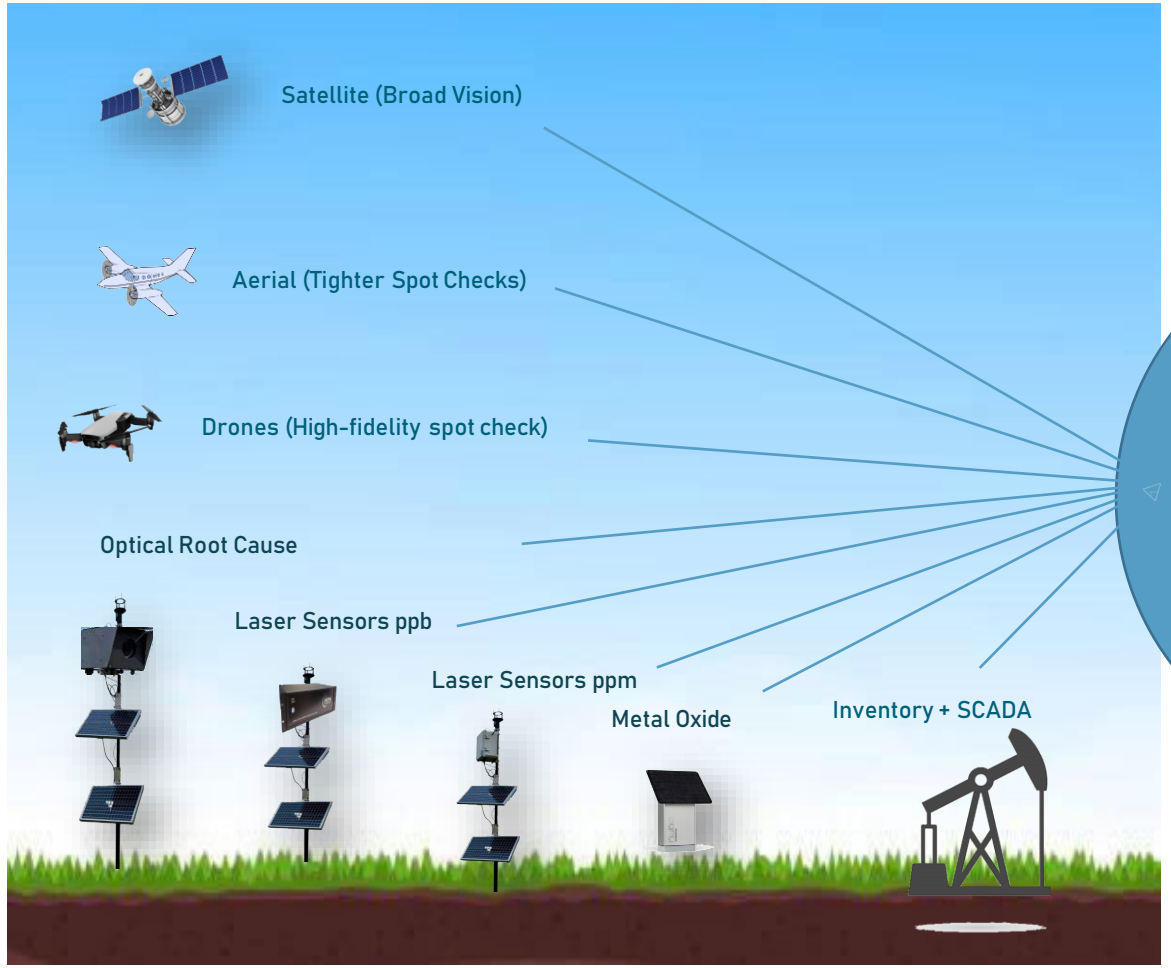
Quantifying Total Site Emissions

- 1 kg/hr X 5 days = 120 kg of methane
- Actionable data to set baselines and prove abatement from changes in equipment or processes



Data for illustration purposes only and not representative of emissions from this specific pad

The Problem: Reconciling Emissions



Reconciliation Process

Evolving Requirements

1. EPA
2. State Agencies
3. SEC Disclosures
4. Corporate Sustainability Metrics
5. Gas Buyers (LNG, hydrogen, utilities)

The Goal: Reconciled Reporting Framework (e.g. OGMP 2.0)

Operators will need to reconcile emissions from Subpart W with site-level measurements (and other relevant technologies)

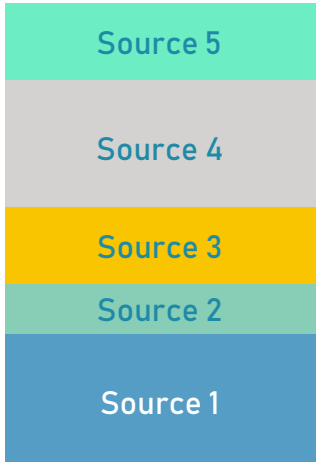
Subpart W Emission Factors:

Source level necessary for mitigation

Investigate sources of discrepancy

Revise source level inventory to reflect learning

Reconciled Emissions




THANK YOU

Project Canary - Who We Are

What We Do

Project Canary (certified B-corp.) is a SaaS-based data analytics company focused on providing accurate emissions management through the energy supply chain and other sectors.

We are the leaders in environmental risk assessments and facility-level emissions measurement using advanced monitoring technology.

Our Investors

INSIGHT PARTNERS

QUANTUM ENERGY PARTNERS

ENERGY IMPACT PARTNERS

Brookfield

CPP INVESTMENT BOARD

By the Numbers

60+ customers
across upstream, midstream, downstream, utilities, landfills, CCS

10+ bcf/d assessed gas

1,900 devices deployed

10,000+ environmental risk assessments

150+ employees
Denver, CO and Hayward, CA

Canary X

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